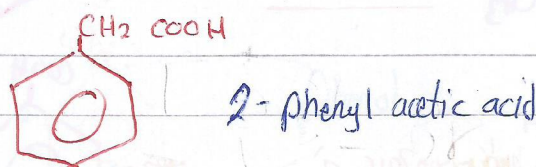
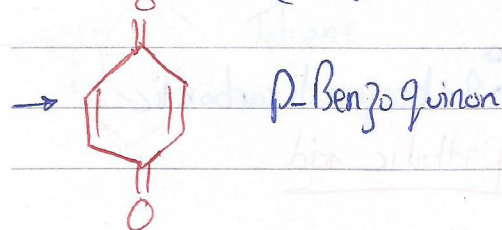
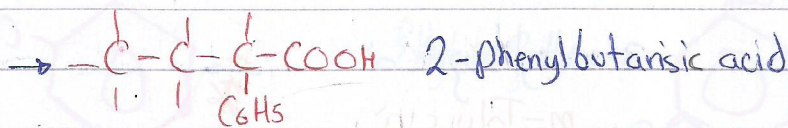
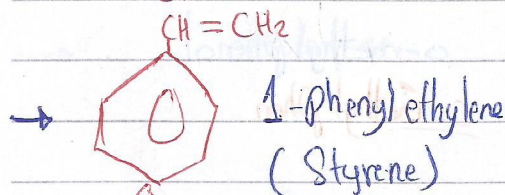
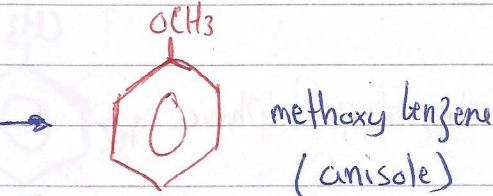
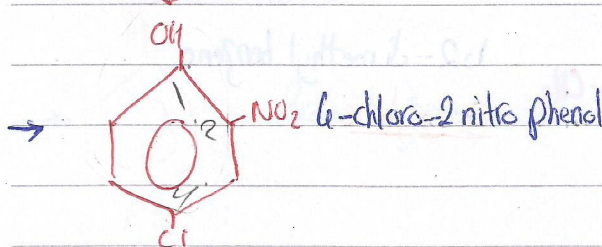
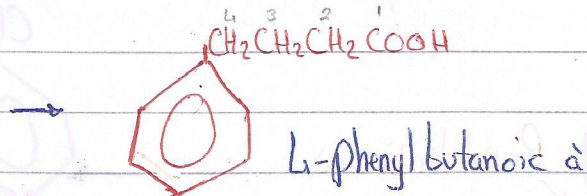
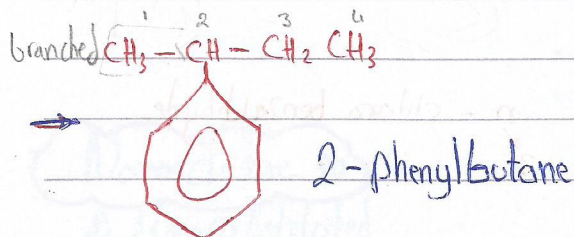
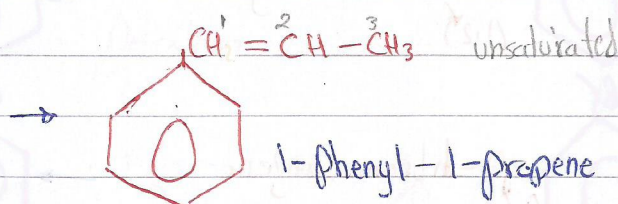
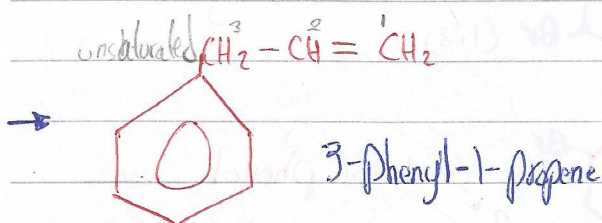
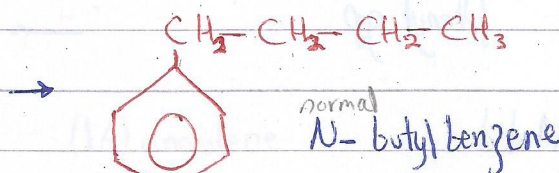
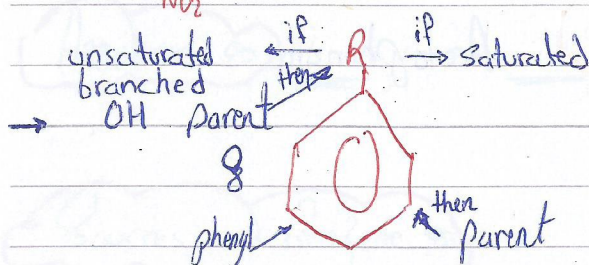
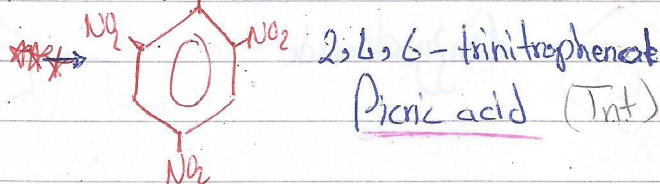
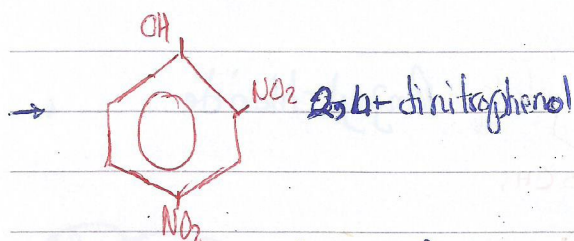
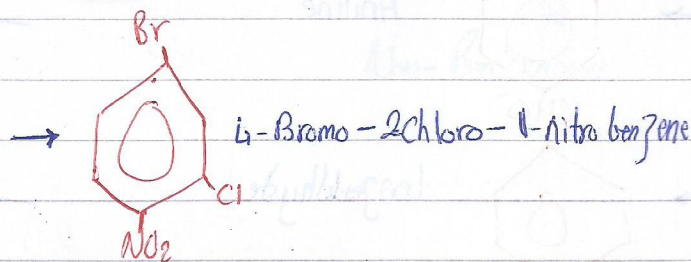
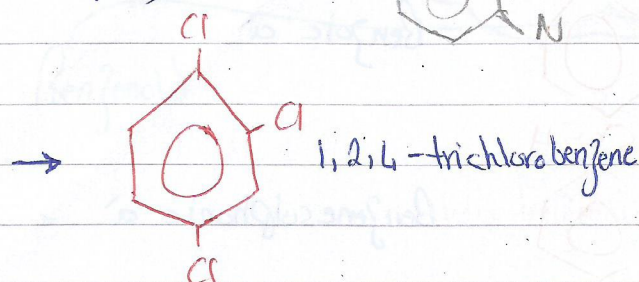
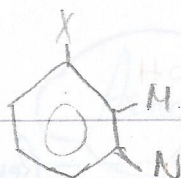


Pec 2

$OH, NH_2, COH, CH_3, COOH$

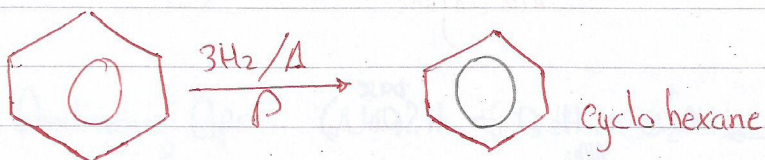
(b)

3) polysubstituted

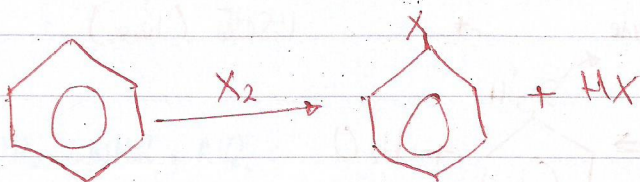


Reactions of Benzene

A) Addition reaction $\rightarrow$ very limited

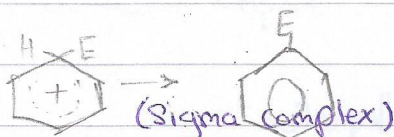


B) Substitution reaction

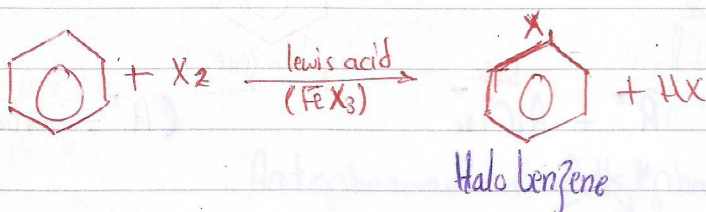


~~xxx~~ Mechanism

- 1) formation of electrophile (E^+)
- 2) formation of arenium ion
- 3) loss of proton



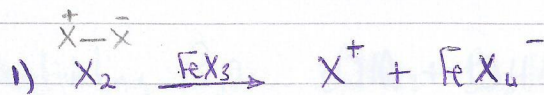
I Halogenation



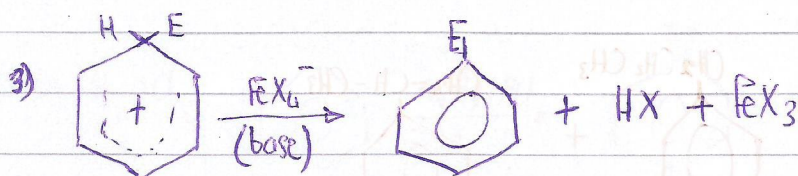
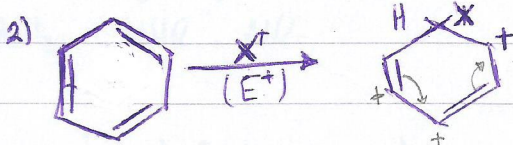
(X = Cl or Br)

F $\rightarrow$ Highly reactive $\rightarrow$ explosions
I $\rightarrow$ not reactive

X^- halide ion
 $\text{X}^\cdot$ free radical



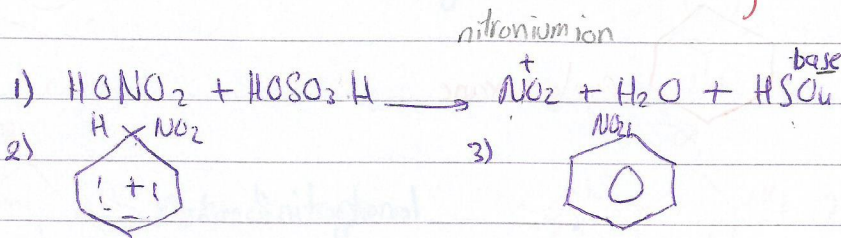
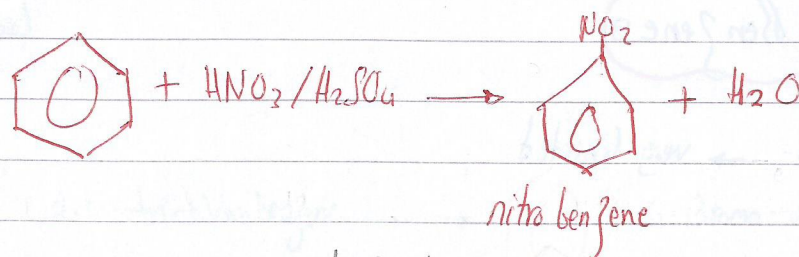
(X^+ (E^+) = halonium ion)



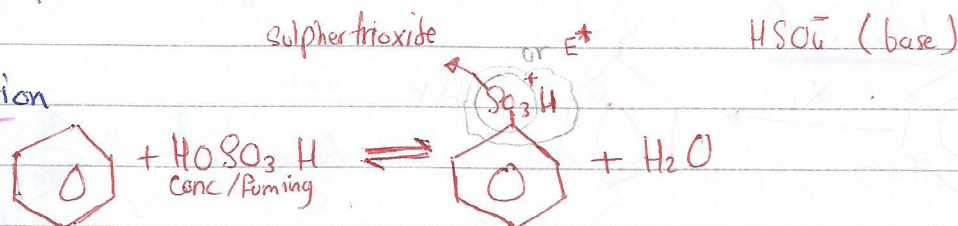
$R-H$ alkane
 $R-$ alkyl
 H^+ proton
 H^- hydride

(6)

2 Nitration

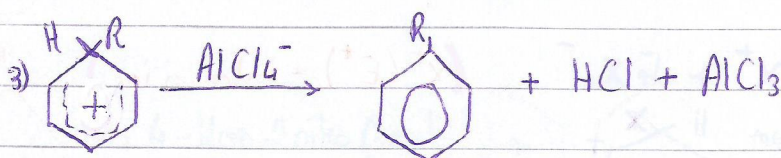
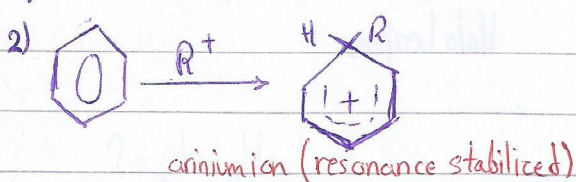
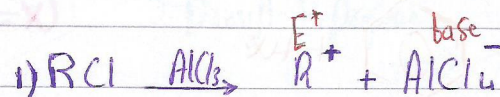
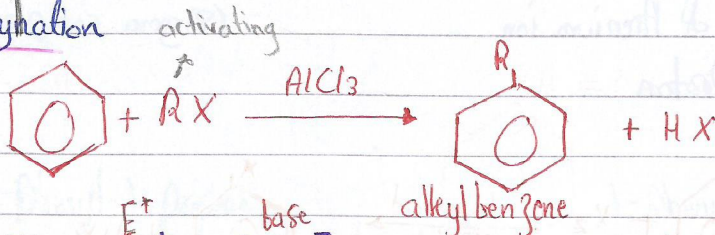


3 Sulphonation



Disulphonation to remove SO_3H from benzene by passing it through water vapour

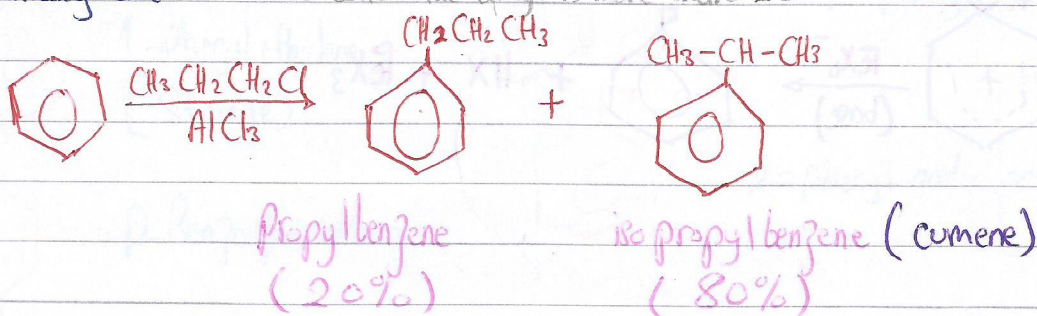
4 Friedel-Craft's alkylation



(R^+ = carbocation) (R^- = carbanion)

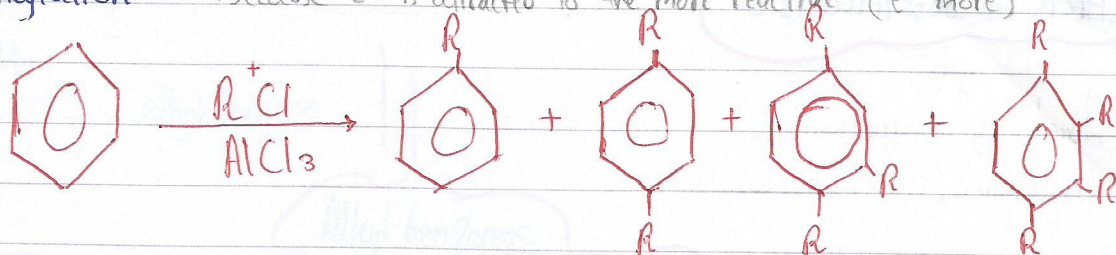
Limitations

1) Rearrangement occurs when the alkyl is more than 2C

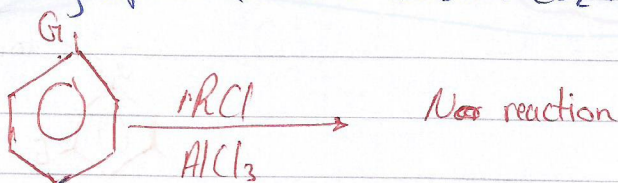


7

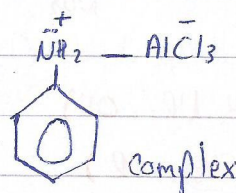
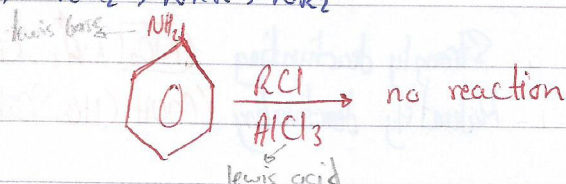
2) Polyalkylation Because E^+ is attracted to the more reactive (e^- more)



3) Deactivating Gps (NO_2 , SO_3H , CO_2H) they don't react with AlCl_3



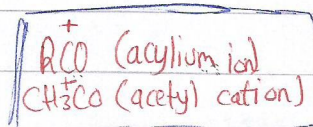
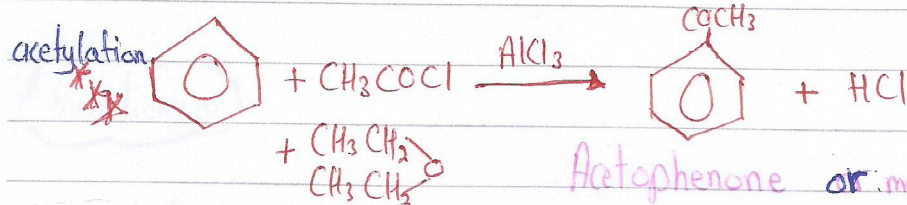
4) NH_2 , NHR , NR_2



5) Friedel-Craft's acylation

($\text{RCO} \rightarrow$ acyl gp) deactivating

($\text{CH}_3\text{CO} \rightarrow$ acetyl gp)



Acetophenone or methyl phenyl ketone or acetyl benzene

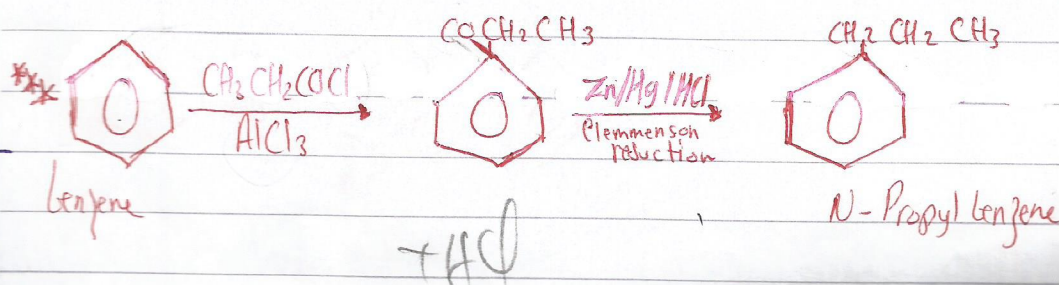
Limitations

1) Deactivating Gps (NO_2 , SO_3H , CO_2H)

2) NH_2 , NHR , NR_2

Because C_6H_6 will be acylated and alkylated

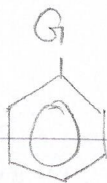
- $\text{C}_6\text{H}_5\text{NO}_2$ and not C_6H_6 is used as solvent in F.C. reactions?



Effects of Substituents

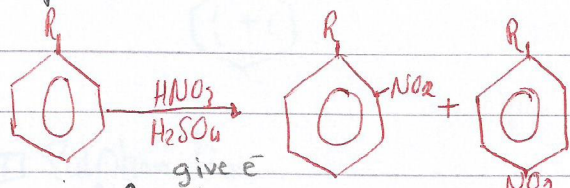
(rate)

- 1) Reactivity of reaction
- 2) Orientation (site of attack)



Substituents

o-p - Directors



→ Activating except Halogen (F, Cl, Br, I)

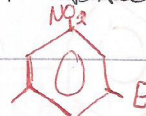
a- Strongly activating ($\text{NH}_2, \text{NR}_2, \text{OH}$)

b- Moderat $\sim$ ($\text{NCOCH}_3, \text{OR}$)

c- Weakly $\sim$ ($\text{R}, \text{C}_6\text{H}_5$)

d- Deactivating (X)

m - Directors



All Deactivating
take e^-
acidic $\uparrow$

a- Strongly deactivating ($\text{NO}_2, \text{NR}_3^+, \text{CF}_3, \text{CCl}_3$)

b- Moderately deactivating ($\text{COOH}, \text{CHO}, \text{SO}_3\text{H}, \text{CN}$)